

CLAIMS

1           1.       An apparatus, comprising:  
2           an expandable member being sized to be positionable in a sphincter; and  
3           an energy delivery device coupled to the expandable member, the energy  
4           delivery device having a configuration that controllably produces lesions of a  
5           sufficient size, number and configuration in an interior of the sphincter so as to create  
6           a selectable tightening of the sphincter.

1           2.       The apparatus of claim 1, wherein the configuration of the energy  
2           delivery device includes a plurality of energy delivery members distributed on a  
3           surface of the expandable member.

1           3.       The apparatus of claim 2, wherein the plurality of energy delivery  
2           members are radially distributed along a surface of the energy delivery device  
3           expandable member.

1           4.       The apparatus of claim 2, wherein the plurality of energy delivery  
2           members are longitudinally distributed along a surface of the expandable member.

1           5.       The apparatus of claim 1, wherein the energy delivery device covers  
2           a portion of the surface of the expandable member.

1           6.       The apparatus of claim 2, wherein the energy delivery device covers  
2           substantially all of an exterior surface of the expandable member

1           7.       The apparatus of claim 1, wherein the expandable member is sized  
2           to be positionable in a sphincter and to allow the energy delivery device to contact a  
3           portion of the inner surface of a sphincter.

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1           8.       The apparatus of claim 1, wherein the expandable member is sized  
2 to be positionable in a sphincter and to allow the energy delivery device to contact all  
3 of an inner surface of the sphincter.

1           9.       The apparatus of claim 1, where the energy delivery device is sized to  
2 be positionable in the sphincter and non-permanently dilate the sphincter from a  
3 contracted state; and  
4           wherein the sphincter returns to a pretreatment contracted state upon a  
5 removal of the expandable member from the sphincter.

1           10.      The apparatus of claim 1, wherein the lesions are formed in a muscle  
2 tissue underlying a sphincter mucosal layer.

1           11.      The apparatus of claim 1, wherein the sphincter is a lower  
2 esophageal sphincter.

1           12.      The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions at a fixed depth from a mucosal surface layer of the  
3 sphincter of no more than 4 mms.

1           13.      The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions and minimizes injury to a mucosal and a  
3 submucosal layer of the sphincter.

1           14.      The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions and reduces a frequency of sphincter relaxation.

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1           15.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions and reduces a duration of sphincter relaxation.

1           16.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions and reduces a frequency of reflux of stomach  
3 contents into an esophagus.

1           17.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions and reduces a frequency of a symptom of reflux of  
3 stomach contents into an esophagus.

1           18.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates the lesions and reduces an incidence of a sequela of reflux of  
3 stomach contents into an esophagus.

1           19.     The apparatus of claim 1, wherein the energy delivery device is  
2 positioned on an exterior surface of the expandable member.

1           20.     The apparatus of claim 1, wherein the energy delivery device is  
2 positioned on an interior surface of the expandable member.

1           21.     The apparatus of claim 1, further comprising:  
2 a lumen positioned in an interior of the expandable member.

1           22.     The apparatus of claim 1, wherein the expandable member is  
2 expandable.

1           23.     The apparatus of claim 1, wherein the expandable member is a  
2 balloon.

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1           24.     The apparatus of claim 1, wherein the expandable member is made  
2 of an expandable material.

1           25.     The apparatus of claim 1, wherein the expandable member is made  
2 of a porous material.

1           26.     The apparatus of claim 1, further comprising:  
2 an electrolytic solution housed in an expanded expandable member.

1           27.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device delivers energy to promote a fibroblast cell infiltration at a site of the  
3 lesions.

1           28.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device delivers energy to promote a fibroblast growth at a site of the lesions.

1           29.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device delivers energy that promotes a mylofibroblast cell infiltration at a site  
3 of the lesions.

1           30.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates a tightening of a lower esophageal sphincter without  
3 permanently damaging anatomical structures near the lower esophageal sphincter.

1           31.     The apparatus of claim 1, wherein the configuration of the energy  
2 delivery device creates a tightening of the lower esophageal sphincter without  
3 permanently damaging an aorta positioned near the lower esophageal sphincter.

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1           32.     The apparatus of claim 1, wherein the configuration of the energy  
2           delivery device creates a tightening of the lower esophageal sphincter without  
3           permanently damaging a vagus nerve positioned near the lower esophageal sphincter.

1           33.     The apparatus of claim 1, wherein the configuration of the energy  
2           delivery device creates a tightening of the lower esophageal sphincter without  
3           permanently damaging an esophageal plexus of nerves and veins positioned near the  
4           lower esophageal sphincter.

1           34.     The apparatus of claim 1, wherein the configuration of the energy  
2           delivery device creates a tightening of the lower esophageal sphincter while preserving  
3           a blood supply to the lower esophageal sphincter.

1           35.     The apparatus of claim 1, wherein the energy delivery device is an  
2           RF electrode.

1           36.     The apparatus of claim 35, further comprising:  
2           an RF energy source coupled to the RF electrode.

1           37.     The apparatus of claim 1, wherein the energy delivery device is a  
2           microwave antenna.

1           38.     The apparatus of claim 37, further comprising:  
2           a microwave energy source coupled to the microwave antenna.

1           39.     The apparatus of claim 1, wherein the energy delivery device is a  
2           waveguide.

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40. The apparatus of claim 39, further comprising:  
a light source coupled to the waveguide.

41. The apparatus of claim 40, wherein the light source is a laser.

42. The apparatus of claim 1, wherein the energy delivery device is an  
acoustical transducer.

43. The apparatus of claim 1, wherein the energy delivery device is a  
resistive heating device.

44. The apparatus of claim 1, further comprising:  
a visualization device coupled to the expandable member.

45. The apparatus of claim 1, further comprising:  
an extension member coupled to the expandable member.

46. The apparatus of claim 45, wherein a proximal portion of the  
extension member is maneuverable by a medical practitioner.

47. The apparatus of claim 1, wherein the energy delivery device is a  
plurality of RF electrodes.

48. The apparatus of claim 47, wherein the plurality of electrodes is a  
flexible circuit.

49. The apparatus of claim 1, further comprising:  
a mechanical expansion device coupled to the expandable member.

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1           50.    An apparatus, comprising:  
2                    an expandable member means sized to be positionable in a lower esophageal  
3 sphincter and non-permanently dilate the lower esophageal sphincter from a  
4 contracted state;  
5                    an energy delivery device means coupled to the expandable member means,  
6 the energy delivery device means having a configuration that controllably produces  
7 lesions of a sufficient size, number and configuration in an interior of the lower  
8 esophageal sphincter to create a tightening of the lower esophageal sphincter; and,  
9                    wherein the lower esophageal sphincter returns to a contracted state upon a  
10 removal of the expandable member means from the sphincter.

1           51.    The apparatus of claim 50, wherein the energy delivery device means  
2 has a configuration that controllably produces lesions an interior of the lower  
3 esophageal sphincter without creating a permanent impairment of the lower  
4 esophageal sphincter's ability to achieve a physiologically normal state of closure.

1           52.    The apparatus of claim 50, wherein the energy delivery device is  
2 positioned on an exterior surface of the expandable member means.

1           53.    The apparatus of claim 50, wherein the energy delivery device is  
2 positioned on an interior surface of the expandable member means.

1           54.    The apparatus of claim 50, further comprising:  
2                    a lumen means positioned in an interior of the expandable member means.

1           55.    The apparatus of claim 50, wherein the expandable member means is  
2 expandable.

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1           56.     The apparatus of claim 50, wherein the expandable member means is  
2 a balloon.

1           57.     The apparatus of claim 50, wherein the expandable member means is  
2 made of an expandable material.

1           58.     The apparatus of claim 50, wherein the expandable member means is  
2 made of a porous material.

1           59.     The apparatus of claim 57, further comprising:  
2 an electrolytic solution means housed in an expanded expandable member  
3 means.

1           60.     The apparatus of claim 50, wherein the configuration of the energy  
2 delivery device means delivers energy to the interior of the lower esophageal sphincter  
3 and creates a fibroblast proliferation in the interior of the lower esophageal sphincter.

1           61.     The apparatus of claim 50, wherein the configuration of the energy  
2 delivery device means delivers energy to the interior of the lower esophageal  
3 sphincter and creates a myofibroblast proliferation in the lower esophageal sphincter.

1           62.     The apparatus of claim 50, wherein the configuration of the energy  
2 delivery device means creates a tightening of the lower esophageal sphincter without  
3 permanently disrupting an aorta positioned near the lower esophageal sphincter.

1           63.     The apparatus of claim 50, wherein the configuration of the energy  
2 delivery device means creates a tightening of the lower esophageal sphincter without  
3 permanently damaging a vagus nerve positioned near the lower esophageal sphincter.



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1           64.     The apparatus of claim 50, wherein the configuration of the energy  
2           delivery device means creates a tightening of the lower esophageal sphincter without  
3           permanently damaging an esophageal plexus of nerves and veins positioned near the  
4           lower esophageal sphincter.

1           65.     The apparatus of claim 50, wherein the configuration of the energy  
2           delivery device means creates a tightening of the lower esophageal sphincter while  
3           preserving a blood supply to the lower esophageal sphincter.

1           66.     The apparatus of claim 50, wherein the configuration of the energy  
2           delivery device means creates a tightening of the lower esophageal sphincter while  
3           creating submucosal lesions in the lower esophageal sphincter.

1           67.     The apparatus of claim 50, wherein the energy delivery device means  
2           is an RF electrode means.

1           68.     The apparatus of claim 47, further comprising:  
2           an RF energy source means coupled to the RF electrode means.

1           69.     The apparatus of claim 50, wherein the energy delivery device means  
2           is a microwave antenna means.

1           70.     The apparatus of claim 69, further comprising:  
2           a microwave energy source means coupled to the microwave antenna means.

1           71.     The apparatus of claim 50, wherein the energy delivery device means  
2           is a waveguide means.

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1           72.    The apparatus of claim 71, further comprising:  
2           a light source means coupled to the waveguide means.

1           73.    The apparatus of claim 72, wherein the light source means is a laser  
2 means.

1           74.    The apparatus of claim 50, wherein the energy delivery device means  
2 is an acoustical transducer means.

1           75.    The apparatus of claim 74, further comprising:  
2           an acoustical energy source means coupled to the acoustical transducer  
3 means.

1           76.    The apparatus of claim 50, wherein the energy delivery device means  
2 is a resistive heating device means.

1           77.    The apparatus of claim 50, further comprising:  
2           a visualization device means coupled to the expandable member means.

1           78.    The apparatus of claim 50, further comprising:  
2           a extension member means coupled to the expandable member means.

1           79.    The apparatus of claim 78, wherein a proximal portion of the  
2 extension member means is maneuverable by a medical practioner.

1           80.    The apparatus of claim 50, wherein the energy delivery device means  
2 is a plurality of RF electrode means.

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81. The apparatus of claim 80, wherein the plurality of electrode means is a flexible circuit means.

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82. The apparatus of claim 50, further comprising:  
a mechanical expansion device means coupled to the expandable member means.

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83. A method of treating a sphincter, comprising:  
providing an expandable member sized to be positionable in the sphincter and configured to non-permanently open the sphincter from a contracted configuration, and an energy delivery device coupled to the expandable member;  
introducing the expandable member in the sphincter;  
dilating the sphincter from the contracted state;  
delivering sufficient energy from the energy source to the sphincter to tighten the sphincter; and  
removing the expandable member from the sphincter.

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84. The method of claim 83, wherein the energy delivery device has a configuration that controllably produces lesions an interior of the sphincter without creating a permanent impairment of the sphincter's ability to achieve a physiologically normal state of closure.

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85. The method of claim 83, wherein energy delivery device delivers sufficient energy to cause a proliferation of fibroblast cells in the sphincter.

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86. The method of claim 85, wherein the energy delivery device delivers sufficient energy to cause a proliferation of myofibroblast cells in the sphincter.

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1           87.     The method of claim 83, wherein the energy delivery device delivers  
2 sufficient energy to create a tightening of the sphincter without permanently damaging  
3 anatomical structures near the sphincter.

1           88.     The method of claim 87, wherein the energy delivery device delivers  
2 sufficient energy to create a tightening of the sphincter without permanently  
3 disrupting an aorta positioned near the sphincter.

1           89.     The method of claim 87, wherein the energy delivery device delivers  
2 a sufficient amount of energy to create a tightening of the lower esophageal sphincter  
3 without permanently damaging a vagus nerve positioned near the sphincter.

1           90.     The method of claim 87, wherein the energy delivery device delivers  
2 a sufficient amount of energy to create a tightening of the lower esophageal sphincter  
3 without permanently damaging an esophageal plexus of nerves and veins positioned  
4 near the sphincter.

1           91.     The method of claim 87, wherein the energy delivery device delivers  
2 a sufficient amount of energy to create a tightening of the lower esophageal sphincter  
3 while preserving a blood supply to the sphincter.

1           92.     The method of claim 83, wherein the energy delivery device creates  
2 a tightening of the lower esophageal sphincter while creating submucosal lesions in  
3 the sphincter.

1           93.     The method of claim 83, wherein the expandable member is  
2 expandable.

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1            94.     The method of claim 73, wherein the expandable member is  
2 introduced in the lower esophageal sphincter in an unexpanded state.

1            95.     The method of claim 94, wherein the expandable member is  
2 expanded to an expanded state when positioned in the sphincter.

1            96.     The method of claim 93, wherein the expandable member is a  
2 balloon.

1            97.     The method of claim 93, further comprising:  
2 an electrolytic solution housed in an expanded expandable member.

1            98.     The method of claim 83, wherein the energy delivery device is an RF  
2 electrode.

1            99.     The method of claim 98, further comprising:  
2 an RF energy source coupled to the RF electrode.

1            100.    The method of claim 83, wherein the energy delivery device is a  
2 microwave antenna.

1            101.    The method of claim 100, further comprising:  
2 a microwave energy source coupled to the microwave antenna.

1            102.    The method of claim 83, wherein the energy delivery device is a  
2 waveguide.

1            103.    The method of claim 102, further comprising:

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2 a light source coupled to the waveguide.

1 104. The method of claim 83, wherein the light source is a laser.

1 105. The method of claim 83, wherein the energy delivery device is an  
2 acoustical transducer.

1 106. The method of claim 105, further comprising:  
2 an acoustical energy source coupled to the acoustical transducer.

1 107. The method of claim 83, wherein the energy delivery device is a  
2 resistive heating device.

1 108. The method of claim 83, wherein the energy delivery device is  
2 delivered to the sphincter transorally without an endoscope.

1 109. The method of claim 83, wherein the energy delivery device is  
2 delivered to the sphincter with an endoscope.

1 110. The method of claim 83, wherein the sphincter is the lower  
2 esophageal sphincter.